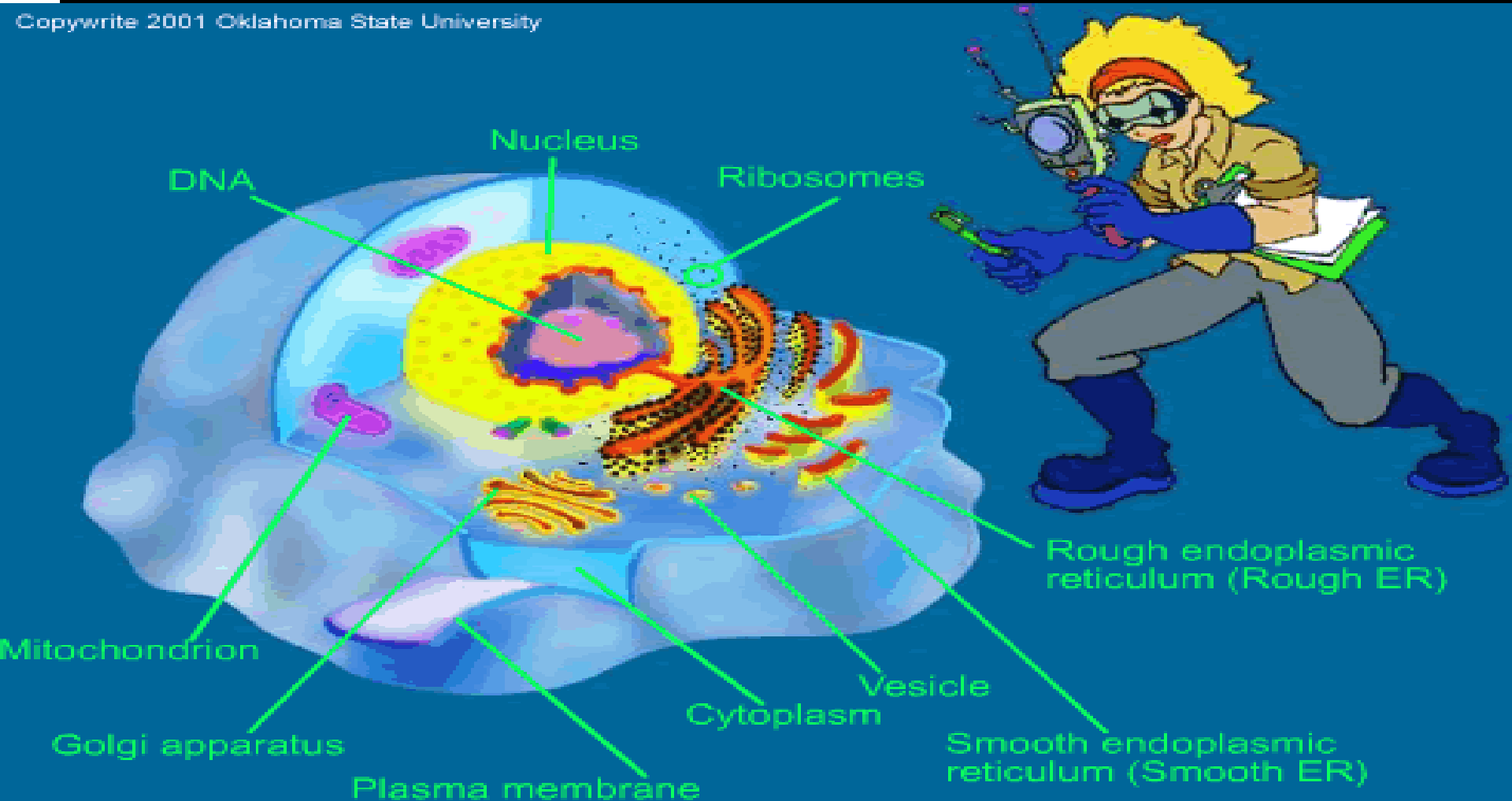




CELL FUNCTION AND STRUCTURE

Cellular Biochemistry: Cell Structure & Function

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The Cell


- A cell is the **smallest** unit of **living** matter.

■



The Cell Theory

The 3 Basic Components of the Cell Theory

1. All organisms are composed of one or more cells. (Schleiden & Schwann)(1838-39)
 2. The cell is the basic unit of life in all living things. (Schleiden & Schwann)(1838-39)
 3. All cells are produced by the division of preexisting cells. (Virchow)(1858)
- 

Modern Cell Theory

Modern Cell Theory contains 4 - statements, in addition to the original Cell Theory:


- 1-The cell contains hereditary information(DNA) which is passed on from cell to cell during cell division.
- 2-All cells are basically the same in chemical composition and metabolic activities.






3-All basic chemical & physiological functions are carried out inside the cells.(movement, digestion,etc)

4-Cell activity depends on the activities of sub-cellular structures within the cell(organelles, nucleus, plasma membrane)




How do we observe cells?

- Light microscope
 - Visible light passes through object
- Electron microscope
 - Scanning - surface of object
 - Transmission - sees through objects
 - 100,000 X to Millions magnification power



How do we know what happens in each part of the cell?

- Radioisotopes are used to "trace" different chemical reactions through a cell.
 - Centrifuge material and analyze each layer.
- 

Structure to Molecular Hierarchy

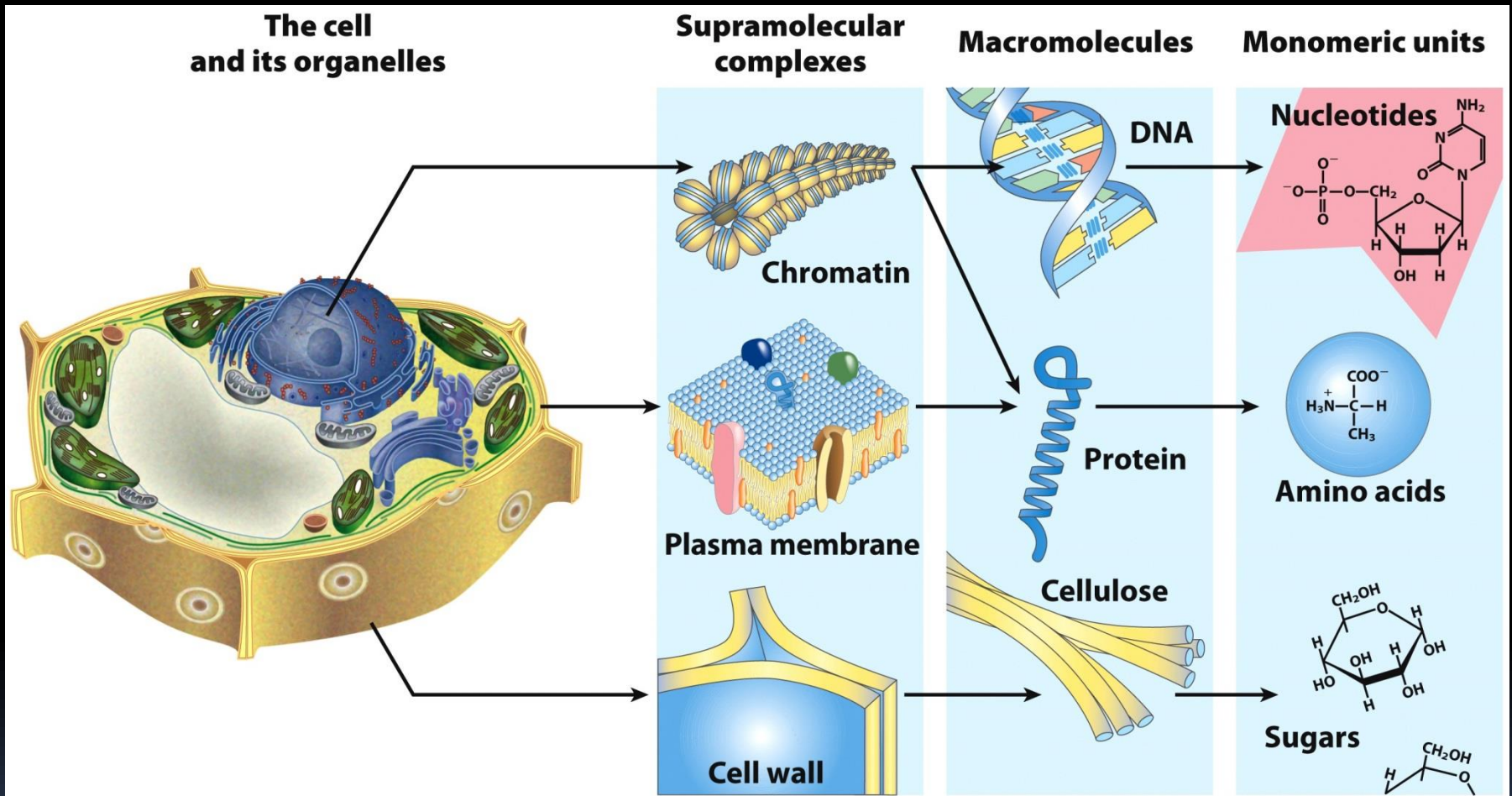



Figure 1-11
Lehninger Principles of Biochemistry, Sixth Edition
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Types of Cells


- Unicellular organisms
 - Bacteria, Protists, etc.
 - Multicellular organisms
 - Plants
 - Animals
 - Muscles, skin, nerves, liver, digestive, bones, blood, immune system, lungs, etc.
- 



Two basic cell types


Eukaryotes (Eu = true) (kary = nucleus) Organisms whose cells contain a membrane-bound nucleus and other organelles.





Prokaryotes (Pro = before
Organisms without a membrane-
bound nucleus (bacteria).

* These cells have genetic
information, but not in a nucleus.




* Evolutionists chose the prefix
“pro” because they
believe these evolved before others.



Prokaryotic Cells

Organisms with prokaryotic cells are called “prokaryotes”

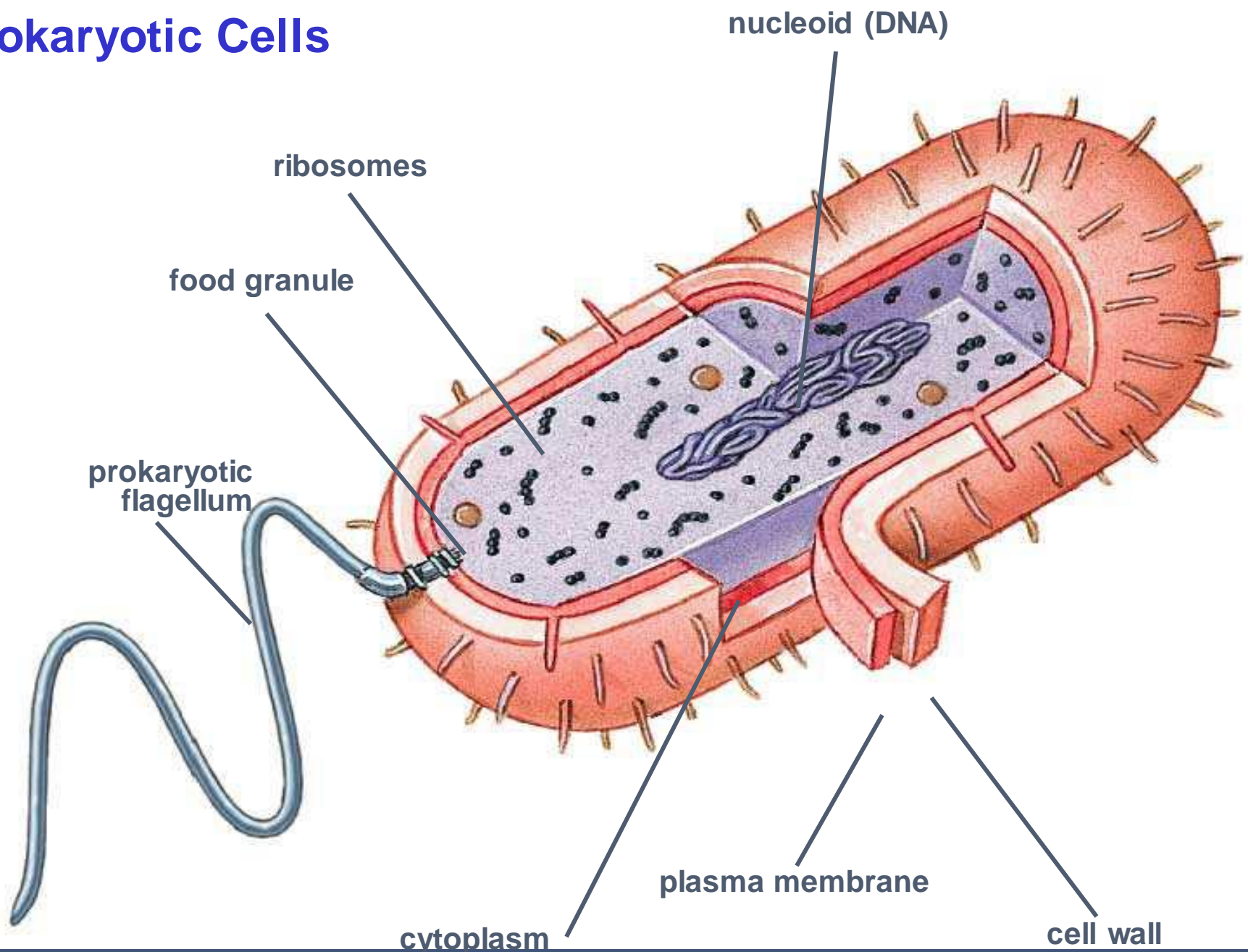
Prokaryotes have **no** true nucleus or organelles.



Have a single strand of “**looped**” DNA

Most prokaryotes are single-celled microscopic organisms.

Prokaryotic Cells

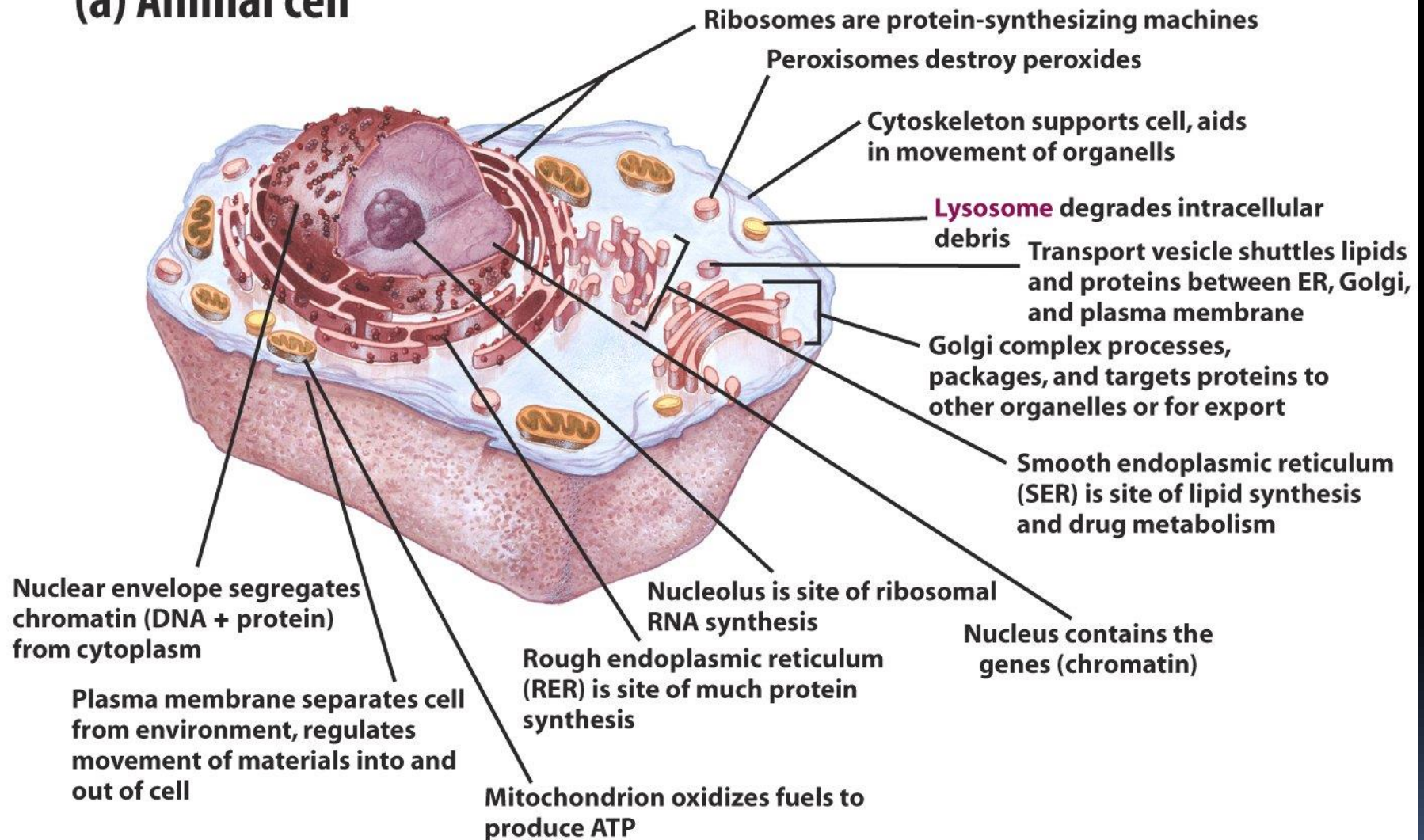


Eukaryotic Cells

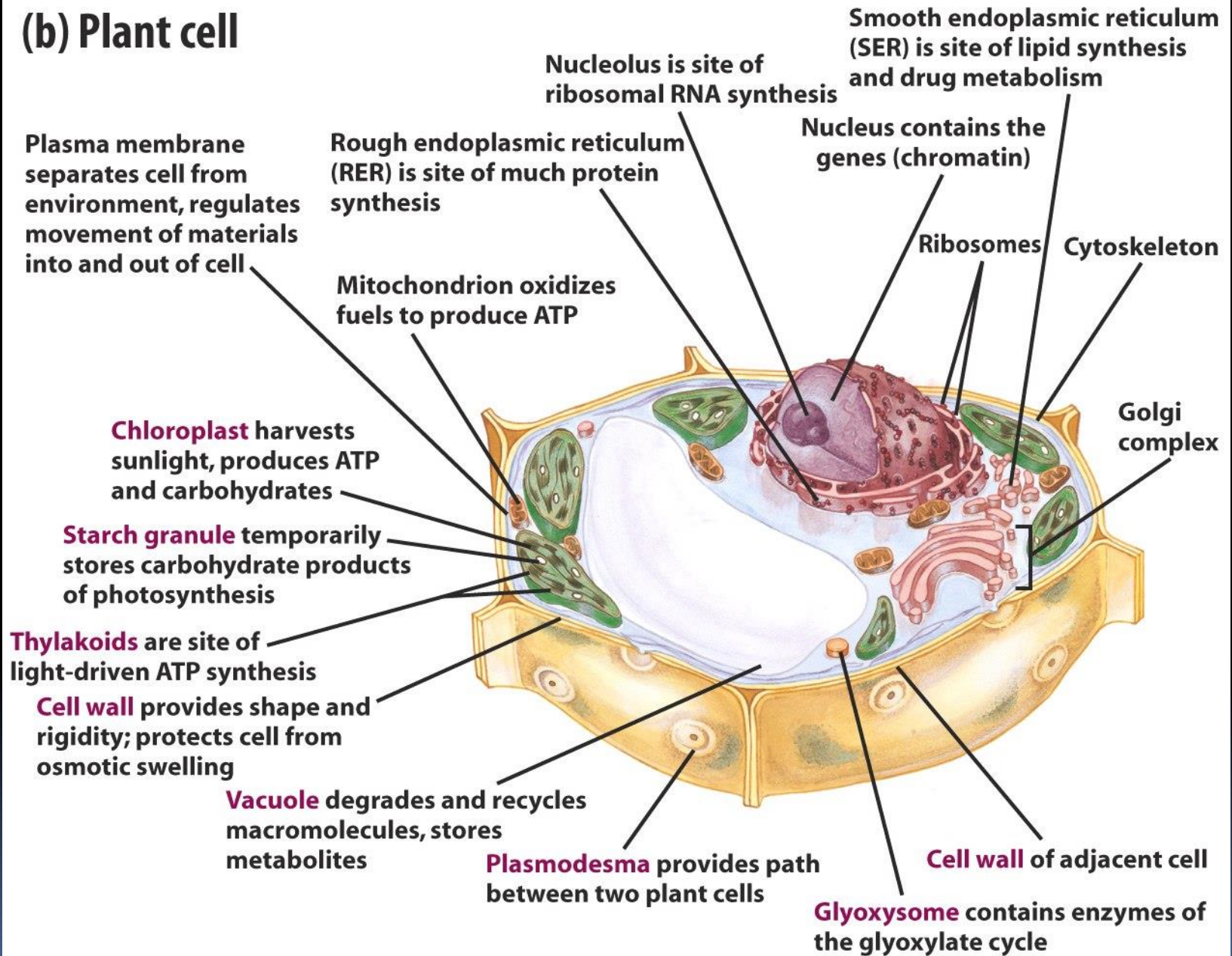
- ▣ Organisms composed of eukaryotic cells are called “eukaryotes”
- ▣ Have a membrane bound nucleus which contains the cell’s DNA
- ▣ All multicellular organisms are eukaryotes
- ▣ Have *organelles*, each of which is surrounded by (or bound in) a “plasma membrane”

Eukaryotic Cell

(a) Animal cell



(b) Plant cell





THREE BASIC PARTS OF THE CELL

1. Cell Membrane

2. Nucleus

3. Cytoplasm

Cell Membrane

- Every cell is surrounded by a cell membrane.
- It is sometimes called a plasma membrane.
- The cell membrane separates the cell from its external environment and from the neighboring cells.

Eukaryotic Cells Structure

- The cell consists of two main compartments:
 - ▣ The nuclear
 - ▣ The cytoplasmic
- The nucleus contains the genetic information that regulates the structure and function of all eukaryotic cells
- The cytoplasm contains numerous cellular organelles, which perform specific functions

Nucleus

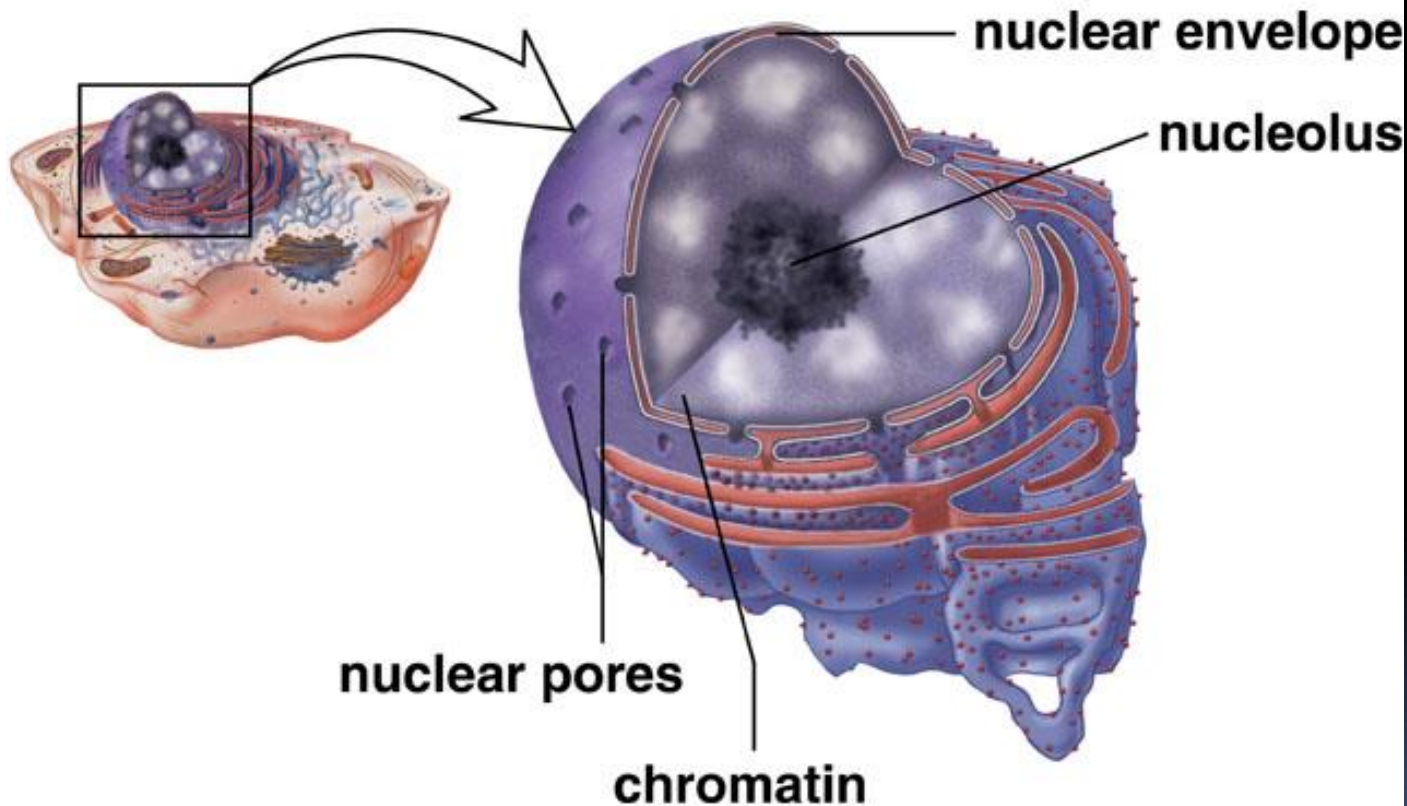
-The nucleus is the most important organelle (Little Body) within the cell. It has two vital functions; to control the activities of the cell and to facilitate cell division.

-This spherical organelle is usually located in or near the center of the cell.

Nucleus: DNA stored here.

The Control Center

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Nuclear envelope:
membrane surrounding the nucleus

Nuclear pores:
open portals of communication between the nucleus & cytoplasm

Chromatin:
condensed DNA

Chromosome:
very tightly packed DNA


Nucleolus:
dense region

Nucleolus (Nucleoli)

- The RNA of ribosomes is synthesized from genes in the nucleolus
- No membranes separate nucleoli from the surrounding chromatin in the nucleus

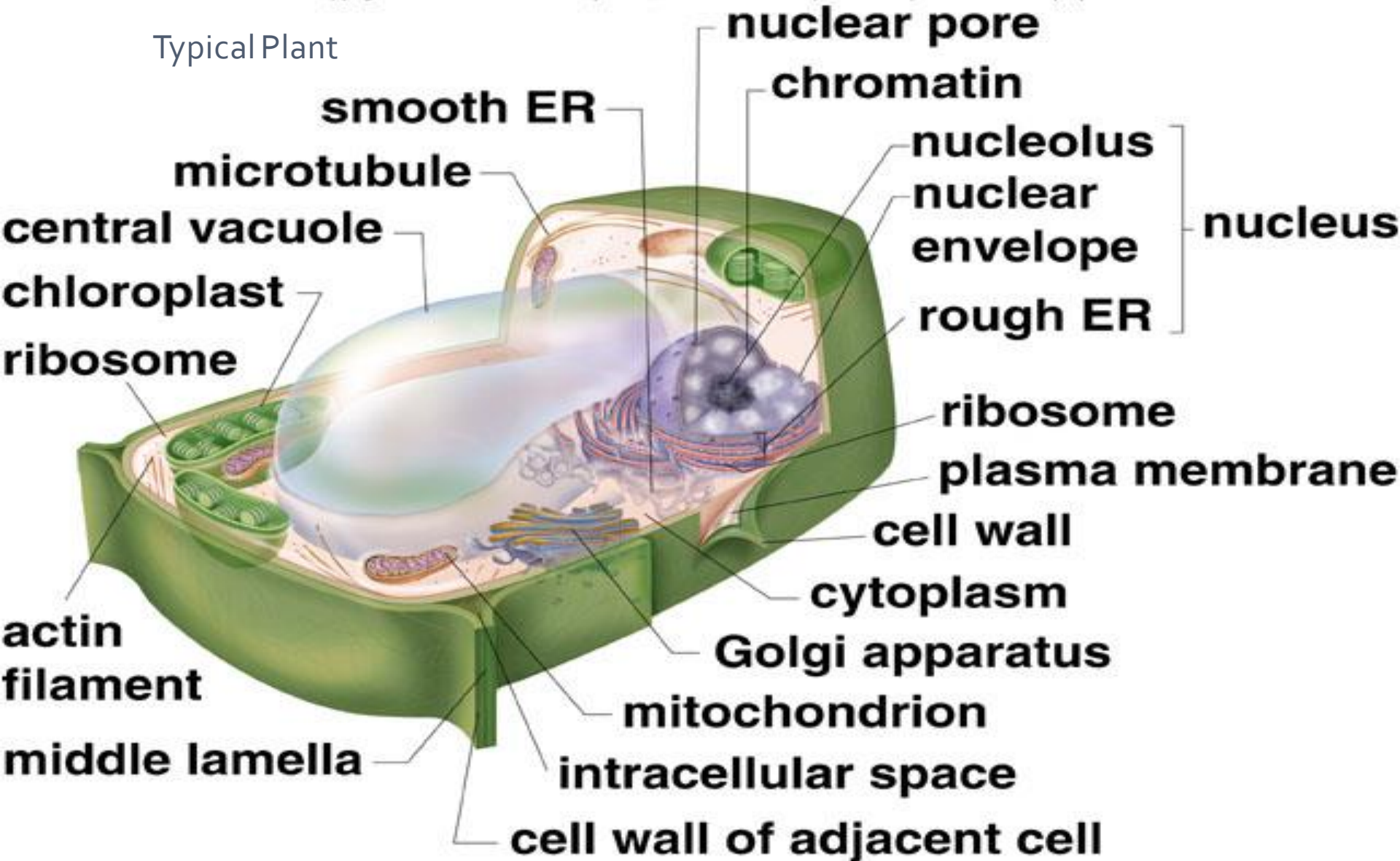
Cytoplasm

- Cytoplasm is a sticky, semi fluid material found between the nucleus and the cell membrane. Chemical analysis of the cytoplasm shows that it consists of proteins, lipids, carbohydrates, minerals, salts, and water.

- 
- In the cytoplasm, mRNA molecules are used by ribosomes as directions for the assembly of proteins
 - DNA -----> mRNA ----->
Protein (enzymes)

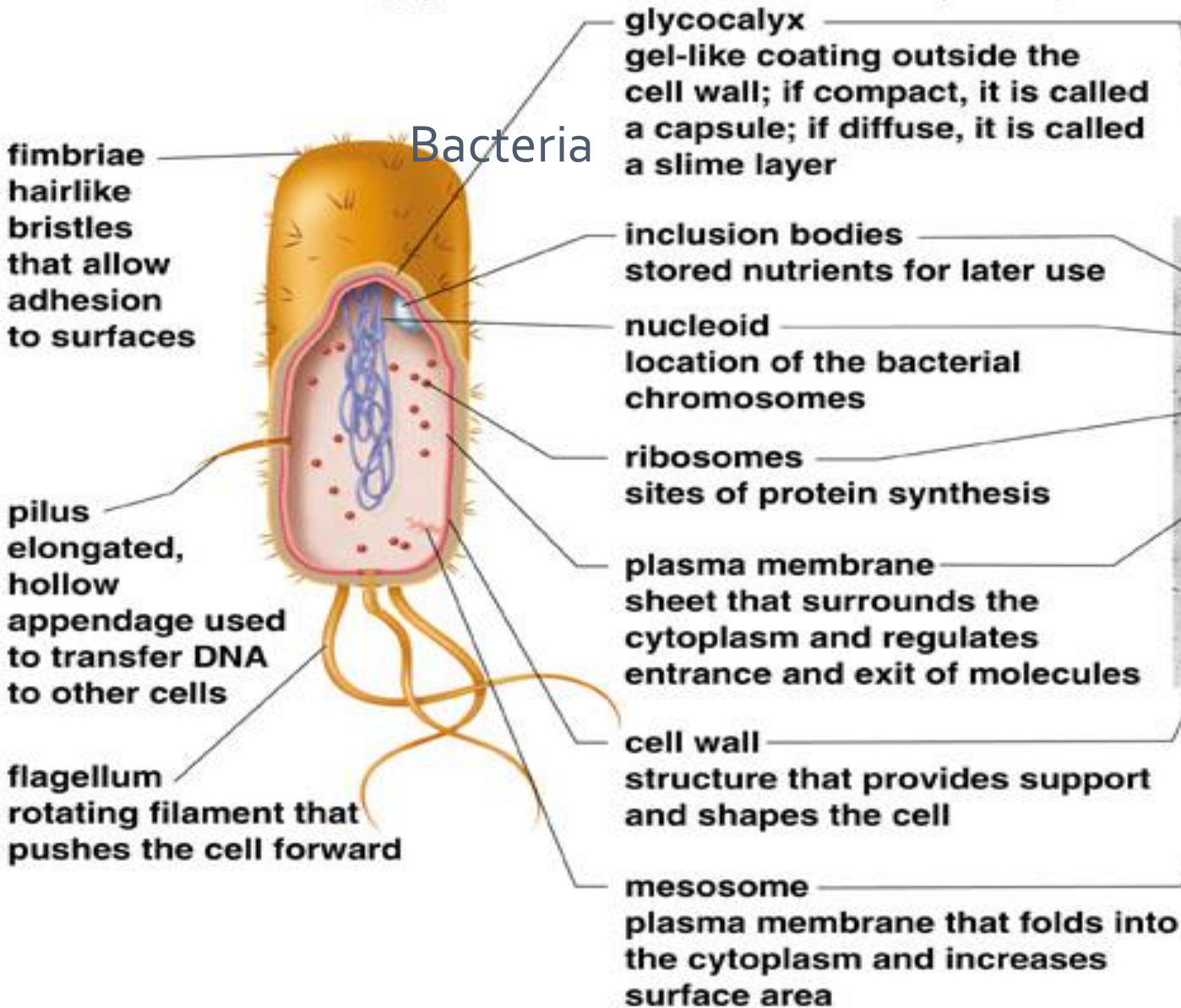
Cell Structure & Function

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Cell Structure & Function

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Plant & Animal Cells

■ Similarities

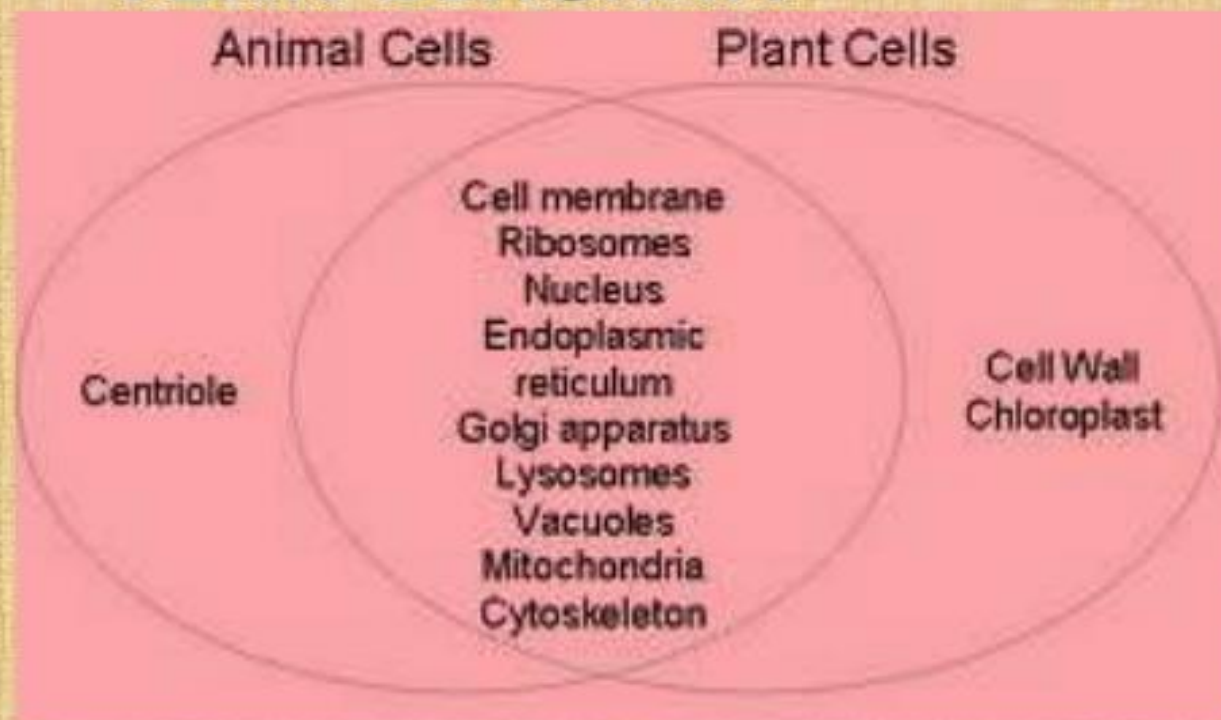
- Both constructed from eukaryotic cells
- Both contain similar organelles
- Both surrounded by cell membrane

Plant & Animal Cells (2)

■ Differences

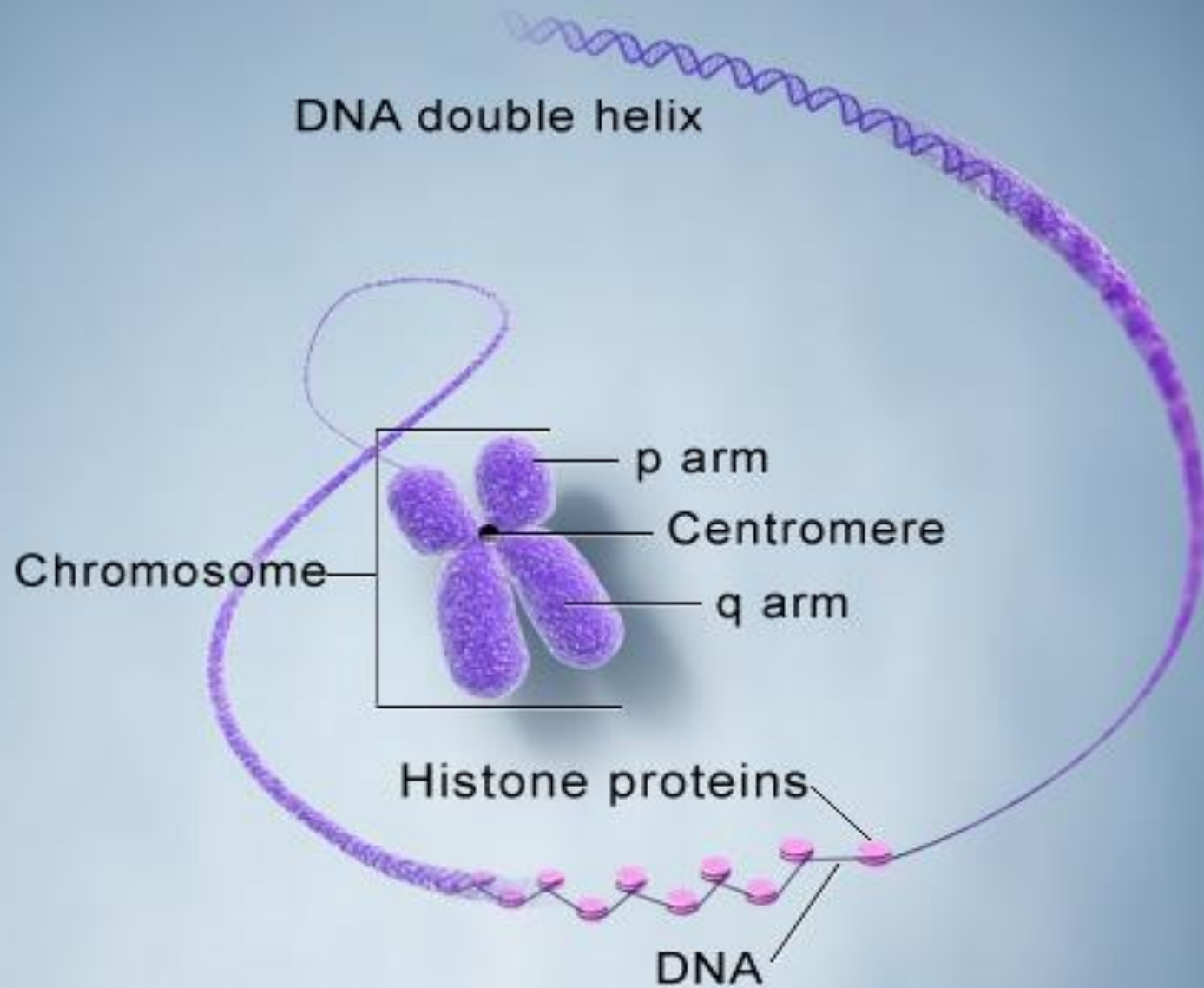
- Plants have
 - Cell wall – provides strength & rigidity
 - Have chloroplasts, photosynthetic site
 - Large vacuoles
- Animals have
 - Other organelle not found in plants (lysosomes formed from Golgi)
 - Centrioles, important in cell division

VENN DIAGRAM

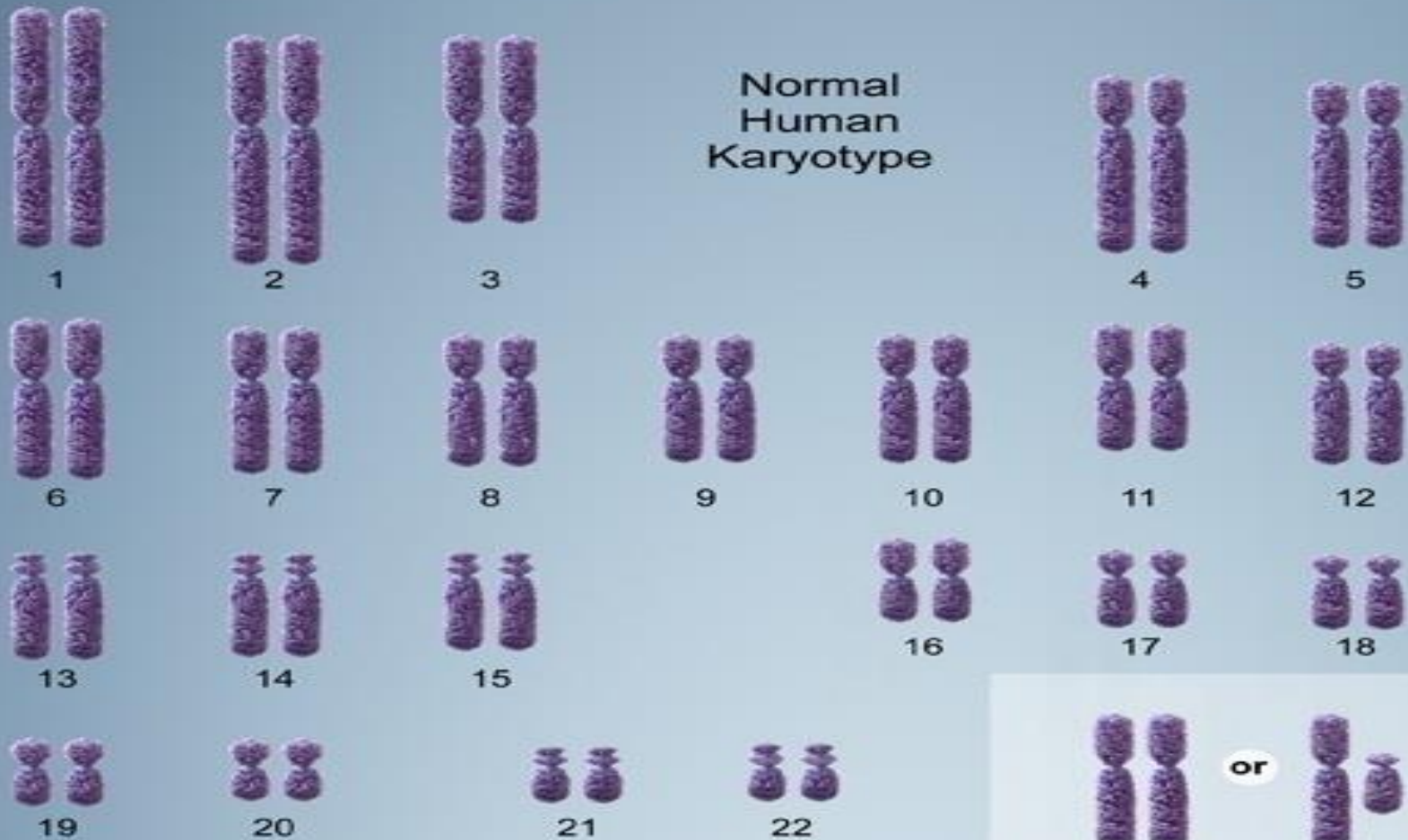


Cellular Organelles

- Cytoplasm
- Nucleus
 - ▣ Chromosomes, nuclear envelope, nuclear pores, nucleolus
- Ribosomes
- Endoplasmic reticulum (smooth & rough)
- Golgi Apparatus
- Lysosomes
- Vesicles
- Peroxisomes
- Vacuoles
- Chloroplast
- Mitochondria
- Cytoskeleton
- Centrioles
- Cilia, Flagella
- Plasma Membrane



Normal Human Karyotype



Autosomes

XX (female) or XY (male)

Sex Chromosomes

Prokaryote and Eukaryote Cells

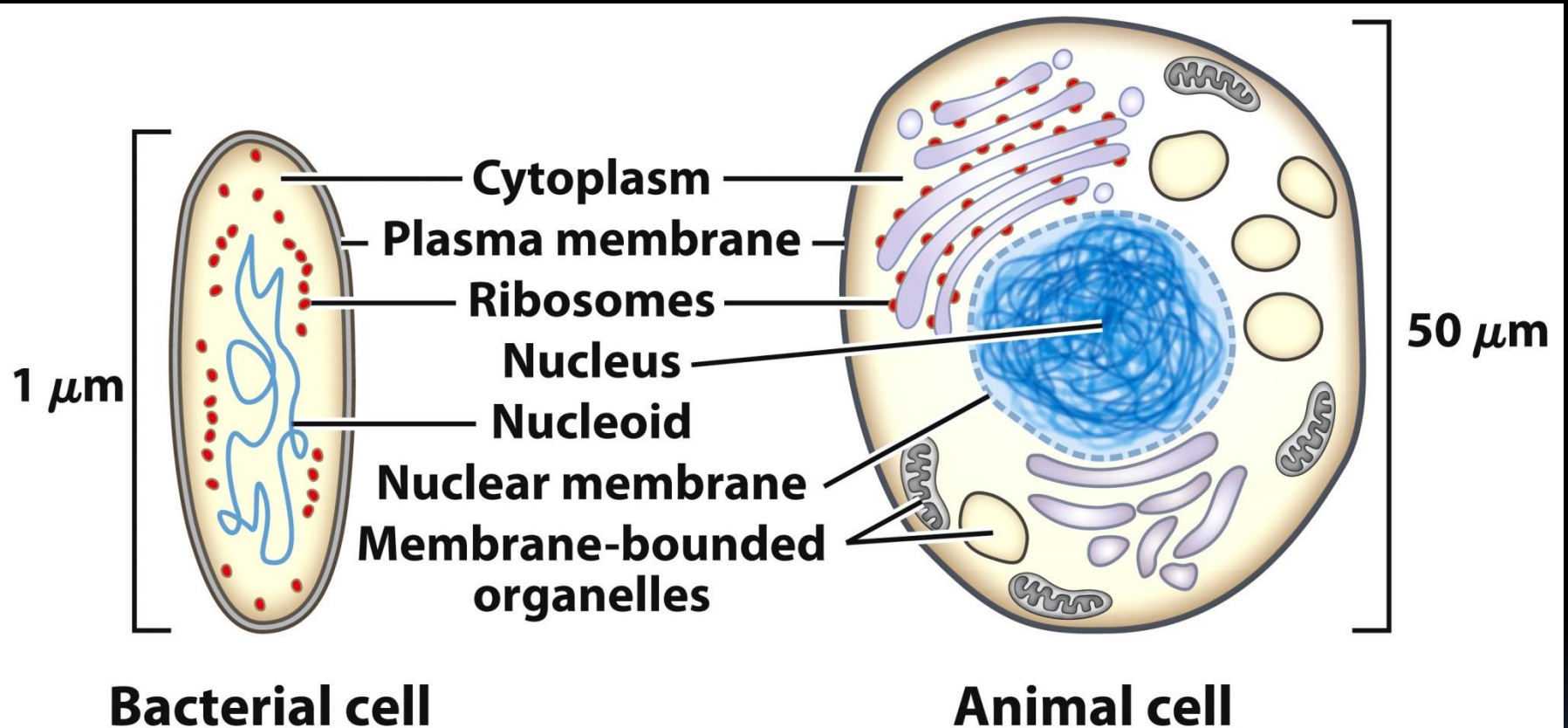


Figure 1-3

End of Chapter (EOC) Problem 1 puts these into 3D: what size you see in a microscope?
what's its volume and how much actin and mitochondria could it hold? how many molecules?

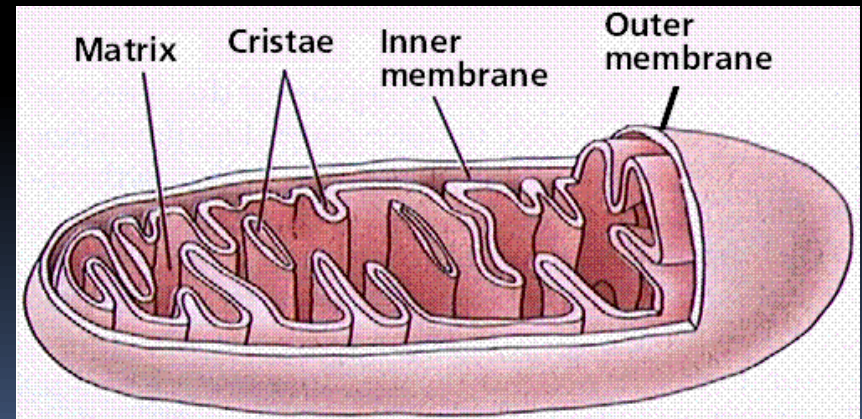
Ribosomes: protein factories

Rough ER: make proteins (studded with ribosomes)

Smooth ER: make lipids, modify proteins made in RER

Mitochondria

- Generate cellular energy in the form of ATP molecules
- ATP is generated by the systematic breakdown of glucose = cell respiration
- Also, surrounded by 2 membrane layers
- Contain their own DNA!
- A typical liver cell may have 1,700 mitoch.




Endoplasmic reticulum

- Rough endoplasmic reticulum
- smooth endoplasmic reticulum
 - are connected and are continuous with the nuclear envelope

Rough endoplasmic reticulum

- It is rough because imbedded in the membrane are ribosomes
- the site of the synthesis of secretory proteins
- The rough ER is also the site for the synthesis of membrane

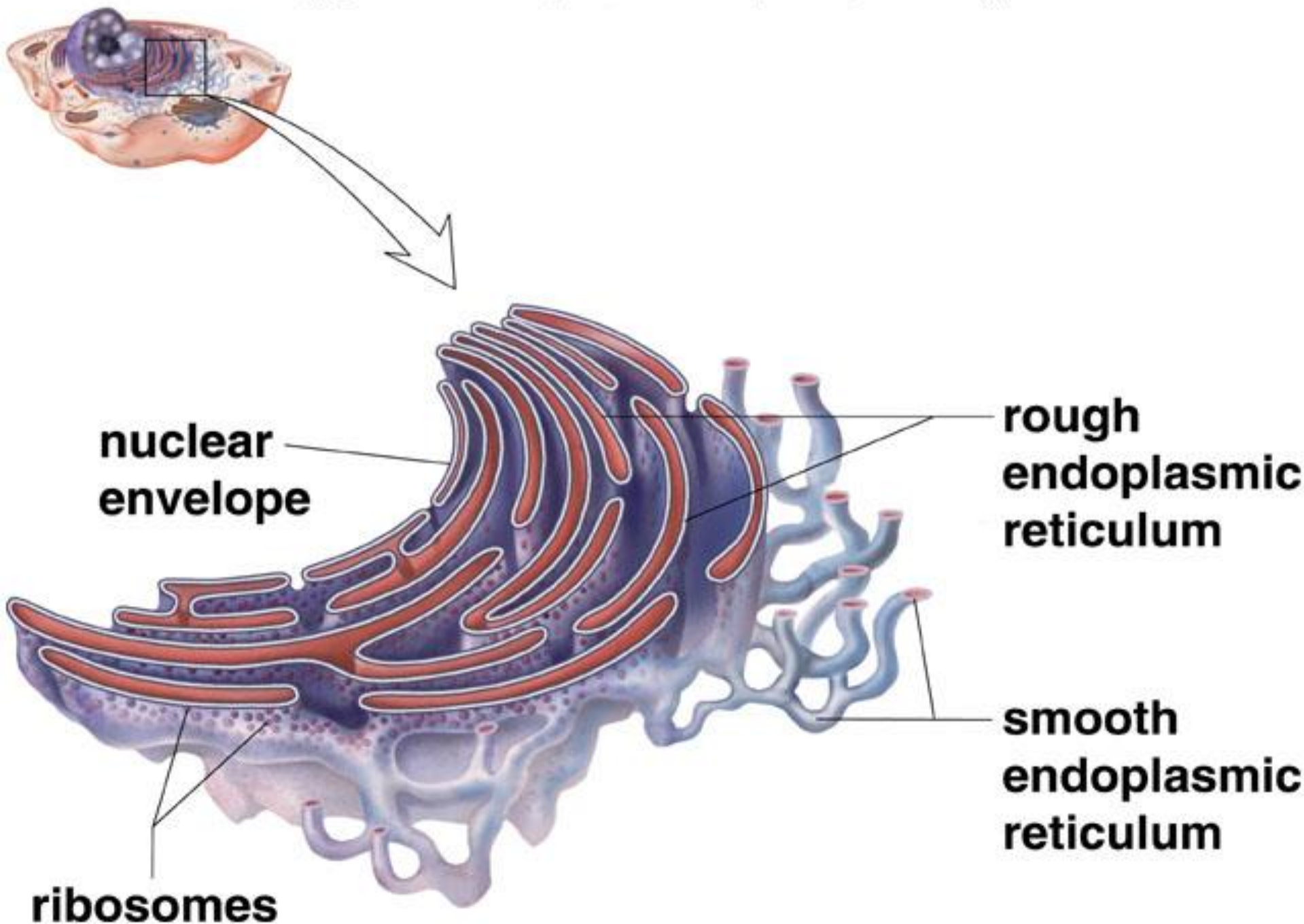
- 
- Enzymes synthesize phospholipid that forms all the membranes of the cell
 - Ribosomes in the rough ER synthesize protein that then are converted to glycoprotein and packaged in transport vesicles for secretion

Smooth endoplasmic reticulum

- The smooth ER is the site for the synthesis of lipids, phospholipids, and steroids
- The smooth ER of the liver has several additional functions
- Enzymes in the smooth ER regulate the release of sugar into the bloodstream



Smooth endoplasmic reticulum

- Other enzymes break down toxic chemicals
- As the liver is exposed to additional doses of a drug the liver increases the
- amount of smooth ER to handle it
- Finally the smooth ER functions to store calcium ions



Golgi apparatus

- The Golgi apparatus, like the ER, is a series of folded membranes
- It functions in processing enzymes and other products of the ER to a finished product
- It is the source of the production of lysosomes

- 
- 
- Receives proteins & lipids in membrane-bound vesicles from ER
 - Modifies those proteins & lipids
 - Sorts and ships the proteins & lipids away in membrane-bound vesicles

Lysosomes

- These are membrane bound vesicles that harbor digestive enzymes
- The membrane of a lysosome will fuse with the membrane of vacuoles releases these digestive enzymes to the interior of the vacuole to digest the material inside the vacuole

Cytoskeleton gives support and
on shape to the cell,
made of proteins



Thank You!

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